## TECHNICAL NOTES

### Nature and sources of data

Data in these tables are based on information from all death certificates filed in the 50 States, the District of Columbia and territories of the United States. The U.S. Standard Certificate of Death was revised in 1989; for additional details see the 1989 revision of the U.S. standard certificates and reports (1) and Technical Appendix of *Vital Statistics of the United States, 1989,* Volume II, Mortality, part A (2). Data for Puerto Rico, the Virgin Islands, Guam, and American Samoa are included in tables showing data by State, but are not included in U.S. totals.

Mortality statistics are based on information coded by the States and territories and provided to the National Center for Health Statistics (NCHS) through the Vital Statistics Cooperative Program (VSCP) and from copies of the original certificates received by NCHS from the State registration offices. In 1997-1999 all the States and the District of Columbia participated in this program and submitted part or all of the mortality data in electronic data files to NCHS. For 1997-1999 all States submitted precoded demographic data for all deaths.

Data for the entire United States refer to events occurring within the United States. Data shown for geographic areas are by place of residence. Beginning with 1970 mortality statistics for the United States exclude deaths of nonresidents of the United States. All data exclude fetal deaths.

Mortality statistics for Puerto Rico, Virgin Islands, and American Samoa exclude deaths of nonresidents of Puerto Rico, Virgin Islands, and American Samoa, respectively. For Guam, however, mortality statistics exclude deaths that occurred to a resident of any place other than Guam or the United States.

### Race and Hispanic origin

Race and Hispanic origin are reported separately on the death certificate. Therefore, data shown by race include persons of Hispanic or non-Hispanic origin, and data for Hispanic origin include persons of any race. In these tables, deaths of Hispanic origin are included in the totals for each race group--white, black, American Indian, and Asian or Pacific Islander (API)--according to the decedent's race as reported on the death certificate. Data shown for Hispanic persons include all persons of Hispanic origin of any race.

Mortality data for the Hispanic-origin population are based on deaths to residents of all 50 States and the District of Columbia. Data year 1997 was the first year that mortality data for the Hispanic population were available for the entire United States.

*Quality of race and Hispanic origin data*--Death rates for Hispanic, American Indian, and API persons should be interpreted with caution because of inconsistencies in reporting

Hispanic origin or race on the death certificate as compared with race on censuses, surveys, and birth certificates. Studies have shown underreporting on death certificates of American Indians, API, and Hispanic decedents; and undercounts of these groups in the censuses (3,4).

A number of studies have been conducted on the reliability of race reported on the death certificate by comparing race on the death certificate with that reported on another data collection instrument, such as the census or a survey. Differences may arise because of differences in who provides race information on the compared records. Race information on the death certificate is reported by the funeral director as provided by an informant or in the absence of an informant, on the basis of observation. In contrast, race on the census or on the Current Population Survey (CPS) is obtained while the individual is alive and is self-reported or reported by another member of the household familiar with the individual and, therefore, may be considered more valid. A high level of agreement between the death certificate and the census or survey report is essential to assure unbiased death rates by race.

Results from several studies (4,5) show that a person self-reported as American Indian or Asian on census or survey records was sometimes reported as white on the death certificate. The net effect of misclassification is an underestimation of deaths and death rates for races other than white and black. In addition, undercoverage of minority groups in the census and resultant population estimates, introduces biases into death rates by race (6-8). Estimates of the approximate effect of the combined bias due to race misclassification on death certificates and underenumeration on the 1990 census are as follows: white, -1.0 percent; black, -5.0; American Indian, +20.6, Asian or Pacific Islander, +10.7 (3).

The National Longitudinal Mortality Study (NLMS) examined the reliability of Hispanic origin reported on 43,520 death certificates with that reported on a total of 12 Current Population Surveys conducted by the U.S. Bureau of the Census for the years 1979-85 (3). In this study, agreement was 89.7 percent for any report of Hispanic origin. The ratio of deaths for CPS divided by deaths for death certificate was 1.07 percent indicating net underreporting of Hispanic origin on death certificates by 7 percent as compared with self-reports on the surveys. Death rates for Hispanic-origin population are also affected by undercoverage of this population group in the census and resultant population estimates; the estimated net correction, taking into account both sources of bias, is 1.6 percent (3,6).

*Other races and race not stated*--Beginning in 1992 all records coded as "Other races" (0.02 percent of the total deaths in 1999) were assigned to the specified race of the previous record. Records for which race was unknown, not stated, or not classifiable (0.10 percent) were assigned the racial designation of the previous record.

Mortality data in the tables are presented for four major race groups, white, black, American Indian or Alaska Native, and Asian or Pacific Islander, in accordance with 1977 U.S. Office of Management and Budget (OMB) standards for presenting Federal statistics on race. Over the next several years, major changes will occur in the way Federal agencies collect and tabulate data on race and Hispanic origin, in accordance with new guidelines from OMB (*Federal Register*, 62FR58781-58790). The major difference between the current and new guidelines is adoption of data-collection procedures in which respondents can identify with more than one race group.

**Cause-of-death classification**

The mortality statistics presented here were compiled in accordance with the World Health Organization (WHO) regulations, which specify that member nations classify causes of death in accordance with the current revision of the *International Statistical Classification of Diseases and Related Health Problems* (ICD). Causes of death for 1979-98 were classified according to the 9th revision of the manual. Effective with deaths occurring in 1999, the United States began using the 10th revision of this classification (7).

Changes in classification of causes of death due to these revisions may result in discontinuities in cause-of-death trends. Discontinuities between Ninth and Tenth Revisions of the ICD for selected causes of death are measured using comparability ratios from a comparability study described in the section *Comparability between ICD-9 and ICD-10 for mortality.*

Besides specifying the classification, WHO regulations outline the form of medical certification and the procedures to be used in coding cause of death. Cause-of-death data presented in this publication were coded by procedures outlined in annual issues of the *NCHS Instruction Manual* (8-10).

Effective with data year 1968, NCHS converted to computerized coding of the underlying cause and manual coding of all causes (multiple causes) on the death certificate. In this system, called Automated Classification of Medical Entities (ACME) (11), the multiple cause codes serve as inputs to the computer software that employs WHO rules to select the underlying cause. Many States have implemented ACME and provide multiple cause and underlying cause data to NCHS in electronic form; for those States that have not, NCHS coded the mortality medical data using ACME.

The ACME system is used to select the underlying cause of death for all death certificates in the United States. In addition, NCHS has developed two computer systems as inputs to ACME. Beginning with 1990 data, the Mortality Medical Indexing, Classification, and Retrieval system (MICAR) (12,13), was introduced to automate coding multiple causes of death. In addition, MICAR provides more detailed information on the conditions reported on death certificates than is available through the International Classification of Diseases (ICD) code structure. Then, beginning with data year 1993, SuperMICAR, an enhancement

of the MICAR system, was introduced. SuperMICAR allows for total literal entry of the multiple cause-of-death text as reported by the certifier. This information is then automatically coded by the MICAR and ACME computer systems. Records that cannot be automatically processed by MICAR or SuperMICAR are manually multiple cause coded and then further processed through ACME.

For 1999 approximately 39 percent of the Nation's death records were multiple-cause coded using SuperMICAR and 61 percent using MICAR only. This represents data from 27 States that were coded by SuperMICAR and data from 23 States, the District of Columbia, and New York City that were coded by MICAR.

In these tables tabulations of cause-of-death statistics are based solely on the underlying cause of death. The underlying cause is defined by WHO as "the disease or injury that initiated the train of morbid events leading directly to death, or as the circumstances of the accident or violence which produced the fatal injury" (7). It is selected from the conditions entered by the physician in the cause-of-death section of the death certificate. When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection rules and modifications. Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. This is captured in NCHS multiple cause-of-death statistics (14-16).

**Cause-of-death ranking**

Cause-of-death ranking is based on numbers of deaths assigned to categories in the List of 113 Selected Causes of Death that was created for use with ICD-10. While the data for 1997 and 1998 were coded using ICD-9, use of this list facilitates the transition to the new coding system which was used for 1999 deaths. Because these tables do not contain all of the 113 causes of death in that list, the tables should not be used to tabulate cause-of-death rankings.

**Comparability between ICD-9 and ICD-10 for mortality**

As a result of the implementation of ICD-10, mortality statistics in the tables are presented using a new ICD-10 standard cause of death list. One of the efforts to maintain the tradition of progress in the classification of diseases has been the practice, begun in 1900, to revise about every 10-20 years what is now the International Classification of Diseases (ICD). Each of these revisions has produced some break in the comparability of cause-of-death statistics. ICD-10 has many changes from ICD-9, including considerably greater detail, shifts of inclusion terms and titles from one category, section, or chapter to another; regroupings of diseases; new titles and sections; and modifications in coding rules (7). As a result, serious breaks occur in comparability for a number of causes of death. Measures of this discontinuity are essential to the interpretation of mortality trends. Ratios of comparability between ICD-9 and ICD-10 have been computed for this purpose.

Comparability studies--also called bridge-coding studies--involve dual classification of a single year of mortality data, that is, classifying the underlying cause of death on mortality by the new revision and the previous revision. The key element of a comparability study is the comparability ratio, which is derived from the dual classification. It is calculated by dividing the number of deaths for a selcted cause of death classified by the new revision by the number of deaths classified to the most nearly comparable cause of death by the previous revision. The resulting ratio represents the net effect of the new revision on statistics for this cause and can be used as a factor to adjust mortality statistics for causes of death classified by a previous revision to be comparable to those for the same cause classified by the new revision.

A comparability ratio of 1.00 indicates that the same number of deaths was assigned to a particular cause or combination of causes whether the Ninth or Tenth Revision was used. A ratio showing perfect correspondence (1.00) between the two revisions does not necessarily indicate that the cause was unaffected by changes in classification and coding procedures but merely that there was no net change.

A ratio of less than 1.00 results from a decrease in assignments of death to a cause in ICD-10 compared with ICD-9. A ratio of more than 1.00 results from an increase in assignments of deaths to a cause in ICD-10 compared with the comparable ICD-9 cause.

One of the major objectives of the comparability study was to furnish ratios that measure the degree of discontinuity between data tabulated by the cause lists published under ICD-10 and data tabulated by the most nearly comparable cause lists published under ICD-9.

Comparability ratios are provided in Tables 1 and 2 for the causes of death presented in these tables.

**Table 1: Comparability Ratios for 42 Specific Causes of Death included in the Mortality Tables**

| SPECIFIC CAUSE OF DEATH | COMPARABILITY RATIO |
|---|---|
| Septicemia | 1.1949 |
| Viral hepatitis | 0.8343 |
| HIV | 1.1448 |
| All cancer | 1.0068 |
| Oropharyngeal cancer | 0.9603 |
| Colorectal cancer | 0.9993 |
| Lung cancer | 0.9837 |
| Skin cancer | 0.9677 |

| | |
|---|---|
| Breast cancer | 1.0056 |
| Cervical cancer | 0.9871 |
| Uterine cancer | 1.0260 |
| Ovarian cancer | 0.9954 |
| Non-Hodgkin's lymphoma | 0.9781 |
| Leukemia | 1.0119 |
| Anemias | 0.9559 |
| Diabetes (underlying cause) | 1.0082 |
| Diabetes-related (multiple cause) | 1.0082 |
| Nutritional deficiencies | 1.1636 |
| Alzheimer's disease | 1.9000 |
| Major cardiovascular diseases | 0.9981 |
| Heart disease | 0.9858 |
| Coronary heart disease (CHD) | 0.9903 |
| Essential (primary) hypertension and hypertensive renal disease | 1.1192 |
| Stroke | 1.0588 |
| Influenza and Pneumonia | 0.6982 |
| Chronic lower respiratory disease | 1.0478 |
| Peptic ulcer | 0.9696 |
| Cirrhosis | 1.0367 |
| Nephritis, nephrotic syndrome and nephrosis | 1.3000 |
| Maternal deaths | * |
| Unintentional injuries | 1.0305 |
| Motor vehicle crashes | ** |
| Falls | 0.8409 |
| Drownings | 0.9904 |
| Residential fire deaths | 0.9743 |
| Firearm-related deaths | 0.9973 |
| Suicides | 0.9962 |
| Homicides | 0.9983 |
| Complications of medical and surgical care | * |
| Drug-induced | 1.1950 |
| Alcohol-induced | 0.9700 |
| Asthma | 0.8938 |

* Figure does not meet standards of reliability or precision. For more information, see the Technical Notes in Hoyert DL, Arias E, Smith BL, Murphy SL, Kochanek KD. Deaths: Final

Data for 1999. National vital statistics reports; vol. 49 no 8. Hyattsville, Maryland: National Center for Health Statistics. 2001.

** Comparability ratio not yet calculated for this cause of death.

**Table 2: Comparability Ratios for 10 Specific Causes of Death included in the Child and Adolescent Mortality Table**

| CAUSES OF DEATH | COMPARABILITY RATIO |
|---|---|
| HIV | 1.1448 |
| All cancer | 1.0068 |
| Heart disease | 0.9858 |
| Chronic lower respiratory disease | 1.0478 |
| Asthma | 0.8938 |
| Congenital malformations, deformations and chromosomal abnormalities | 0.8470 |
| Accidents, all | 1.0305 |
| Motor vehicle accidents | 0.9978 |
| Suicides | 0.9962 |
| Homicides | 0.9983 |

**Quality of reporting and processing cause of death**

One index of the quality of reporting causes of death is the proportion of death certificates coded to the Ninth Revision; Chapter XVI; Symptoms, signs, and ill-defined conditions (ICD-9 Nos. 780-799) for 1997 and 1998 and to the proportion of death certificates coded to Chapter XVIII; Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (ICD-10 codes R00-R99) for 1999. Although deaths occur for which the underlying causes are impossible to determine, this proportion indicates the care and consideration given to the certification by the medical certifier. This proportion also may be used as a rough measure of the specificity of the medical diagnoses made by the certifier in various areas. In 1999, 1.12 percent of all reported deaths in the United States were assigned to Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified. The percent of deaths from this cause for all ages combined generally has remained stable since 1990.

**Population bases for computing rates**

The population used for computing death rates in these tables (furnished by the U.S. Bureau of the Census) represents the population residing in the specified area, enumerated as of April 1 for census years and estimated as of July 1 for all other years. Death rates for the United States for 1999 are based on population estimates as of July 1, 1999, and are available by 5-year age groups on the mortality Web site at http://www.cdc.gov/nchs/datawh/statab/unpubd/mortabs.htm (17). The estimates are based

on the 1990 census level counts. The 1990 census level counts by race were modified to be consistent with U.S. Office of Management and Budget categories and historical categories for death data (18).

Population estimates for each State, Puerto Rico, Virgin Islands, Guam and American Samoa, shown in the tables, are based on demographic analysis and, therefore, are not subject to sampling variation (19-23).

**Computation of rates**

Rates in these tables are calculated on a three-year average basis and are per 100,000 estimated population in a specified group and/or area. They are calculated as:

$$\frac{(D_{(1997)} + D_{(1998)} + D_{(1999)})/3}{P_{(1998)}}$$

where

$D_{(year)}$ = number of deaths in a specific year

$P_{(year)}$ = population estimate in a specific year

Age-adjusted death rates are used to compare relative mortality risk across groups and over time. However, they should be viewed as a construct or an index rather than as direct or actual measures of mortality risk. Statistically, they are weighted averages of the age-specific death rates, where the weights represent the fixed population proportions by age (24). The age-adjusted rates presented in these tables were computed by the direct method, that is, by applying the age-specific death rates for a given cause of death to the U.S. standard population (relative age distribution of 2000 estimated population of the United States), which is shown in table I along with the corresponding weights used for computing the RSE*(R*=) in the preceding formulas.

**Table I. United States standard population, 2000: Numbers and proportions (weights)**

| Age | Number | Weights ($w_i$) |
|---|---|---|
| All ages..... | 1,000,000 | 1.000000 |
| Under 1 year..... | 13,818 | 0.013818 |
| 1-4 years..... | 55,317 | 0.055317 |
| 5-14 years..... | 145,565 | 0.145565 |
| 15-24 years..... | 138,646 | 0.138646 |
| 25-34 years..... | 135,573 | 0.135573 |
| 35-44 years..... | 162,613 | 0.162613 |
| 45-54 years..... | 134,834 | 0.134834 |
| 55-64 years..... | 87,247 | 0.087247 |

| Age | Number | Weights ($w_i$) |
|---|---|---|
| 65-74 years..... | 66,037 | 0.066037 |
| 75-84 years..... | 44,842 | 0.044842 |
| 85 years and over..... | 15,508 | 0.015508 |

Age-adjusted rates for Puerto Rico, Virgin Islands, Guam, and American Samoa were computed by applying the age-specific death rates to the U.S. standard population. Age groups for 75 years and over were combined because population counts were unavailable by age group for ages over 75 years. The year 2000 standard population and corresponding weights used for computing age-adjusted rates and relative standard errors for the territories are shown in table II.

**Table II. United States standard population, 2000: Numbers and proportions (weights)**

| Age | Number | Weights ($w_i$) |
|---|---|---|
| All ages..... | 1,000,000 | 1.000000 |
| Under 1 year..... | 13,818 | 0.013818 |
| 1-4 years..... | 55,317 | 0.055317 |
| 5-14 years..... | 145,565 | 0.145565 |
| 15-24 years..... | 138,646 | 0.138646 |
| 25-34 years..... | 135,573 | 0.135573 |
| 35-44 years..... | 162,613 | 0.162613 |
| 45-54 years..... | 134,834 | 0.134834 |
| 55-64 years..... | 87,247 | 0.087247 |
| 65-74 years..... | 66,037 | 0.066037 |
| 75 years and over..... | 60,350 | 0.060350 |

By using the same standard population, death rates for the total population and for each race-sex group were adjusted separately. The age-adjusted rates were based on 10-year age groups. It is important not to compare age-adjusted death rates with crude rates.

Death rates for the Hispanic population are based only on events to persons reported as Hispanic. Rates for non-Hispanic white persons are based on the sum of all events to white decedents reported as non-Hispanic and white decedents with origin not stated. Hispanic origin is not imputed if it is not reported.

**Random variation**

1. $$RSE(D) = RSE(R) = 100\sqrt{\frac{1}{D}}$$

The mortality data in these tables are not subject to sampling error. Mortality data, even based on complete counts, may be affected by random variation. When the number of events is small (perhaps less than 100) and the probability of such an event is small, considerable caution must be observed in interpreting the data. Such infrequent events may be assumed to follow a Poisson probability distribution. For this distribution, the relative standard error (RSE) is a measure of the variability. For computing RSE-s in percent, this formula may be used for the tables:

where

$D$ = number of deaths

$R$ = rate

A dash is shown in place of a rate based on fewer than 20 deaths, which is the equivalent of an *RSE(R)* of 23 percent or more. A RSE(R) of 23 percent is considered statistically unreliable. For age-adjusted death rates, this criterion was based on the sum of the age-specific deaths.

For the number of deaths (*D*) (where D is 100 or more) the chances are 95 in 100 that

2. $$D - 1.96 * D * \frac{RSE(D)}{100} \quad and \quad D + 1.96 * D * \frac{RSE(D)}{100}$$

cover the "true" number of deaths. This is referred to as a 95-percent confidence interval. For computing 95-percent confidence intervals when D is less than 100 deaths, see the NHCS Web site, Mortality Data from the National Vital Statistics System: http://www.cdc.gov/nchs and refer to ATechnical Appendix from *Vital Statistics of United States*: Mortality, 1995 (or 1999*).@

For age-specific death rates (based on 100 or more deaths) for the $i^{th}$ age group ($R_i$), the 95-percent confidence interval

3. $$R - 1.96 * R * \frac{RSE(R)}{100} \quad and \quad R + 1.96 * R * \frac{RSE(R)}{100}$$

will include the "true" rate. For computing 95-percent confidence intervals for $R$ when $D$ is less than 100 deaths, see the web site mentioned above.

For testing the difference between two rates ($R_1$ and $R_2$, each based on 100 or more deaths), the following z-test may be used to define a significance test statistic:

4. $$z = \frac{R_1 - R_2}{\sqrt{R_1^2\left(\frac{RSE(R_1)}{100}\right)^2 + R_2^2\left(\frac{RSE(R_2)}{100}\right)^2}}$$

If *z* $ 1.96, then the difference is statistically significant at the 0.05 level and if z < 1.96, the difference is not significant. For computing statistical tests when $R_1$ and/or $R_2$ are based on less than 100 deaths, see the web site mentioned above.

For an age-adjusted death rate ($R$:), the RSEs in formulas 3 and 4 above would be substituted by this formula:

5. $$RSE(R') = 100\frac{\sqrt{\Sigma\left\{w_i^2 R_i^2\left(\frac{1}{D_i}\right)\right\}}}{R'}$$

where:

$R_i$ = age-specific rate for the $i^{th}$ age group

$w_i$ = $i^{th}$ age-specific U.S. standard population such that

$3(w_i)$=1.000000 (see table V and age-adjusted death rate under "Definition of terms")

$D_i$ = number of deaths for the $i^{th}$ age group

The calculation of measures of variability by cause of death take into account the variability of the comparability ratio modified 1998 data for comparison with the 1999 data. For information on the statistical tests, please refer to *A Guide to State Implementation of ICD-10 for Mortality, Part II: Applying Comparability Ratios* (25) at the following Web site: http://www.cdc.gov/nchs/datawh/statab/unpubd/comp.htm.

**Availability of mortality data**

Mortality data are available in publications, unpublished tables, and electronic products as described on the NCHS web site at the following address: http://www.cdc.gov/nchs. The data are available on data tapes from the National Technical Information Service (NTIS) and on CD-ROM from NTIS and the Government Printing Office (GPO) . Data are also available in the *Vital Statistics of the United States*, Mortality, and *Vital and Health Statistics*, Series 20 reports, and the *National Vital Statistics Reports* through NCHS.

**Definitions of terms**

*Age-specific death rate*—Deaths per 100,000 population in a specified age group, such as 1–4 years or 5–9 years for a specified period.

*Age-adjusted death rate*—The death rate used to make comparisons of relative mortality risks across groups and over time. This rate should be viewed as a construct or an index rather than as direct or actual measure of mortality risk. Statistically, it is a weighted average of the age-specific death rates, where the weights represent the fixed population proportions by age (24).

**References**


1. Tolson GC, Barnes JM, Gay GA, Kowaleski JL. The 1989 revision of the U.S. standard certificates and reports. National Center for Health Statistics. Vital Health Stat 4(28). 1991.
2. National Center for Health Statistics. Technical appendix. Vital statistics of the United States, 1989, vol II, mortality, part A. Washington, DC: Public Health Service. 1993.
3. Rosenberg HM, Maurer JD, Sorlie PD, Johnson, NJ, et al. Quality of death rates by race and Hispanic origin: A summary of current research,1999. National Center for Health Statistics. Vital Health Stat 2(128). 1999.
4. Sorlie PD, Rogot E, Johnson NJ. Validity of demographic characteristics on the death certificate. Epidemiology 3(2):181-4. 1992.
5. Poe GS, Powell-Griner E, McLaughlin JK, et al. Comparability of the death certificate and the 1986 national mortality followback survey. National Center for Health Statistics. Vital Health Stat 2(118). 1993.

6. Hogan H. The 1990 post-enumeration survey: Operations and results. J Am Stat Assoc. Vol 48 no 423: 1047-1060. 1993.
7. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. Geneva: World Health Organization. 1992.
8. National Center for Health Statistics. Vital statistics, instructions for classifying the underlying cause of death. NCHS instruction manual; part 2a. Hyattsville, Maryland: Public Health Service. Published annually.
9. National Center for Health Statistics. Vital statistics, instructions for classifying multiple causes of death. NCHS instruction manual; part 2b. Hyattsville, Maryland: Public Health Service. Published annually.
10. National Center for Health Statistics. Vital statistics, nonindexed terms, standard abbreviations, and State geographic codes used in mortality data classification. NCHS instruction manual; part 2e. Hyattsville, Maryland: Public Health Service. Published annually until 1999.
11. National Center for Health Statistics. Vital statistics, ICD-9 ACME decision tables for classifying underlying causes of death. NCHS instruction manual; part 2c. Hyattsville, Maryland: Public Health Service. Published annually.
12. National Center for Health Statistics. Vital statistics, data entry instructions for the mortality medical indexing, classification, and retrieval system (MICAR). NCHS instruction manual; part 2g. Hyattsville, Maryland: Public Health Service. Published annually.
13. National Center for Health Statistics. Vital statistics, dictionary of valid terms for the mortality medical indexing, classification, and retrieval system (MICAR). NCHS instruction manual; part 2h. Hyattsville, Maryland: Public Health Service. Published annually.
14. Chamblee RF, Evans MC. TRANSAX, the NCHS system for producing multiple cause-of-death statistics, 1968-78. National Center for Health Statistics. Vital Health Stat 1(20). 1986.
15. Israel RA, Rosenberg HM, Curtin LR. Analytical potential for multiple cause-of-death data. Am J Epidemiol 124(2): 161-79. 1986.
16. National Center for Health Statistics. Public use data file documentation: Multiple cause of death for ICD-9, 1998 data. Hyattsville, Maryland: Public Health Service. 2000.
17. U.S. Bureau of the Census. Unpublished census file NESTV99. Consistent with populations published in: U.S. population estimates, by age, sex, race, and Hispanic origin: 1990-1999. Washington, DC. 2000.
18. National Center for Health Statistics. Technical Appendix. Vital statistics of the United States, 1990, vol II, mortality, part A. Washington: Public Health Service. 1994.
19. U.S. Bureau of the Census. Population estimates for the U.S. and States by single year of age and sex: July 1, 1999. Internet release date: March 9, 2000. http://www.census.gov/population/estimates/state/stats/st-99--10.txt.

20. U.S. Bureau of the Census. Unpublished Census file PUERTO99.
21. U.S. Bureau of the Census. Unpublished Census file USVI99.WK1.
22. U.S. Bureau of the Census. Unpublished Census file GUAM99.WK1.
23. U.S. Bureau of the Census. Unpublished Census file ASAMOA99.WK1.
24. Feinleib M, Zarate AO, eds. Reconsidering age adjustment procedures: Workshop proceedings. National Center for Health Statistics. Vital Health Stat 4(29). 1992.
25. Minino AM. A guide to State implementation of ICD-10 for mortality, part II: Applying comparability ratios. Hyattsville, Maryland: National Center for Health Statistics. 2000.